It is interesting to note how this very earnest and conscientious teacher treats his subject, as he evidently endeavours to present the main results of scientific research to his readers so that they may be prepared for the shock of a possible future meeting with scientific doctrines which might imperil their faith.

The "Church" has, very wisely, not pronounced definitely on many scientific problems, and concerning these it is open to an intelligent Roman Catholic to hold fairly advanced views; for example, the cosmogony of the Bible is one of these, and the reader is permitted to take his choice of the three main interpretations of this account. The most, too, is made of our ignorance concerning the origin of life and the actual precursors of man. The author regards himself as an evolutionist, but he is not a thoroughgoing one, as he distinctly affirms that the theory of evolution can neither be applied to the origin of life nor to man. He asserts that

> "evolution, even had it realised the progression which unites all animals in one nature, could not have produced that new creation which is known as an intelligent and free man."

The author admits that the volume has no scientific pretensions, and he goes on to say "were it judged with the utmost rigour it would not disturb me." All the same, the book would have been less open to criticism if it had been looked over by specialists, as there are many statements of theories or facts that, to say the least, it would have been much better to have put differently, and there are many errors of nomenclature and misprints that should have been avoided. For example, Noctiluca is called a "jelly fish" (p. 75), *Aurelia oecrita* (*sic*) is termed a Madusa (p. 82). As examples of errors of fact may be instanced, the Australians are credited with a "wide head" (p. 368); the Bushmen are degenerate Hottentots, and these, according to "eminent ethnologists," are "emigrant Egyptians, debased and deformed by misery" (p. 372).

We have given this book as much space as it deserves as a popular exposition of human origins; but nevertheless it is probable that it will be of service, as it should make some religious people think on subjects that they too often ignore, and, at all events, it will indicate to "good Catholics" that certain of their own religious teachers do not entirely repudiate modern science or entirely reject the theory of evolution.

OUR BOOK SHELF.

Atti della Fondazione scientifica Cagnola. Vol. xvii. Pp. xxvi + 355. (Milan: Tip Bernardoni di C. Rebeschini, &c., 1900.)

UNDER the Cagnola foundation, two prizes are annually awarded for essays on subjects proposed by the founder, and one prize of about 100*l.*, with a gold medal of the value of 20*l.*, are awarded on a subject chosen by the Reale Istituto Lombardo. The theme for 1898 was a critical exposition of the theory of electrical dissociation, and the successful memoir by Profs. Angelo Battelli and Annibale Stefanini forms the subject of the present volume.

Among the various theories of solution, that of van 't Hoff, which regards the dissolved substance in a dilute solution as existing in the gaseous state, has found much favour; but determinations of molecular weight derived by this hypothesis do not agree, especially in the case of electrolytes, with those obtained by other methods or deduced from the chemical formulæ. This circumstance, coupled with the fact that the least electromotive force suffices to generate a current in an electrolyte, had already led Clausius to replace the hypothesis of Grotthus by other theories; and Arrhenius, observing that the anomalies in the osmotic pressure and the freezing-points occur exclusively in solutions of electrolytes, was led to the hypothesis that these contain the acids and salts in a state of dissociation, increasing with the dilution.

This hypothesis of electrolytic dissociation has been put by the authors to a variety of tests in connection with the mechanical phenomena of osmotic pressure, optic phenomena, thermal phenomena connected with freezing- and boiling-point determinations, and, lastly, electric phenomena; and while many of the results favour the hypothesis of the existence of free ions in solutions, others are difficult to reconcile with this theory. Thus the degree of dissociation required to account for optic phenomena does not always agree with that deduced from cryoscopic or ebullioscopic observations, or from electric conductivity. Moreover, the authors do not consider it conclusively proved that there is no inferior limit to the electromotive force sufficient to set up a current in an electrolyte.

It will be thus seen that Profs. Battelli and Stefanini have opened up a wide field of discussion in connection with electrolytic theories, and that their work, both theoretical and experimental, will be of no small assistance to chemists and physicists interested in researches in this subject.

An Elementary Treatise on Qualitative Chemical Analysis. By Prof. T. F. Sellers, A.M. Pp. 160. (Boston: Ginn and Co., 1900.)

THE author justifies his contribution to the long list of analytical works by pointing to the inevitable gap. The gap no doubt exists. The question is whether it is desirable to fill it. We have analytical books which mean business, and, being written for analysts and not for students, are crowded with practical details. Then there are the countless examination cram books, which by tabular and other devices direct the student by the shortest cuts to his ultimate goal—the discovery of the constituents of salts, simple and complex. The present little volume is to fill the gap which lies between these two extremes, and its advantages are set forth in the preface under six principal heads and eight subsidiary ones. Without transcribing literally these manifold recommendations, it may suffice to say that the book opens with the principles of analytical chemistry by introducing the theory of solution, osmotic pressure and electrolytic dissociation, and proceeds with the usual series of qualitative tests for bases and acids and their methods of separation.

However desirable it may be for even an elementary student to gain some knowledge of analytical chemistry based upon the modern theory of solution, a beginner should first be confronted with his experimental facts. A reversal of the present order might therefore be adopted with advantage. An advantage, too, would be derived from the introduction of a few illustrations, descriptive of the apparatus mentioned in the text.

As to whether a student, such as the author contemplates, who does not intend to specialise in chemistry, gains very much from the detailed study of analytical operations, is open to question.

The study of qualitative analysis as a substantial part of elementary practical chemistry has been determined largely by tradition, partly, too, by the exigencies of examination, to which it readily lends itself; but it is worth consideration whether the emphasis laid upon it

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on these grounds is not exaggerated, and whether a student who studies chemistry for one year could not fill his time with practical problems of greater value.

J. B. C.

Microbes et Distillerie. Par Lucien Lévy. Pp. vi + 323. Paris : Carré et Naud, 1900.)

THIS book, which deals with the micro-organisms connected with distilling operations, supplies a good illustration of the rapid progress that is being made in the study of technical mycology. M. Lévy confines himself strictly to his subject, and does not wander into the details of practice, and yet the three hundred and twenty odd pages of his book are none too many for a very brief *résumé* of much that is known concerning the relations of micro-organisms to the distilling industry. But brief and condensed though it is, it is accurate and very fairly complete, and, moreover, possesses that charm of simple rendering which is so characteristic of the best class of French scientific literature.

The book will be useful to all interested in the technology of the fermentation industries; but we are inclined to go farther, and also recommend it to the notice of students of pathogenic micro-organisms. There appears to be some little danger of too wide a separation of this branch of bacteriology from the science as a whole, and any such artificial division can only work for harm. Probably much of the knowledge gained concerning the micro-organisms of fermentation and their actions has some bearing on pathological bacteriology, and for this reason we recommend M. Lévy's book to pathological bacteriologists as a concise and suggestive *résumé* of another branch of their science. Doubtless it reflects more especially the work and views of the French school, but then it is published in the land of Pasteur.

A. J. B.

The Fifth Report upon the Fauna of Liverpool Bay and the Neighbouring Seas. Edited by Prof. W. A. Herdman, F.R.S. Pp. ix + 336. Twelve plates. (Liverpool Marine Biology Committee, 1900.)

THE reports and other publications of the Liverpool school of naturalists have provided material for many paragraphs in our "Notes" columns, the latest "Memoir" published by the Liverpool Marine Biology Committee having been noticed quite recently (p. 330). The present volume contains reprints of the annual reports of the Committee, from the ninth to the thirteenth inclusive, papers communicated to the Biological Society of Liverpool on Copepoda, Hydromedusæ, Turbellaria, Actinia, and an abnormal Echinus, and a list of the marine fauna and flora of the Irish Sea. The record of the L.M.B.C. is brought down to the end of its sixteenth year, and observations extending over several years, referring to the marine biology of Liverpool Bay and the Irish Sea, are rendered available in a convenient form. The volume stands as substantial evidence of what valuable work a few good naturalists can do, even when the financial resources are limited.

Analytical Tables for Complex Inorganic Mixtures. Arranged by F. E. Thompson, A.R.C.S. Pp. 7. (Stafford : *Chronicle* Office.) Post free, 1*s.* 7*d.*

A SERIES of tables suitable for use in chemical laboratories where students are working at qualitative chemistry, with an examination like that of the advanced stage of practical inorganic chemistry of the Board of Education in view. The tables show how to conduct a preliminary examination of a substance in the dry way, and in the wet way for metals; and they describe the usual treatment of group precipitates and filtrates. There are also tables for examination for acids and giving confirmatory tests for acids.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Mathematics and Physics in Public Schools.

A WELL-ATTENDED conference of science masters in public schools was held last month at the University of London, and among the many interesting papers read was one by Mr. W. D. Eggar, of Eton, on the coordination of mathematics and physics in our public schools.

In answer to that paper I endeavoured to point out at the time that the present want of cohesion between these studies was due, not to the incapacity of the instructors in these subjects, but to the illiberality of the system still prevailing, not only in the Universities to which many of the boys eventually go, but also to an equal degree in these public schools themselves.

I will here take the opportunity of thanking the editor of NATURE for his courtesy in inviting me to express my views at greater length. This letter is a plea for a change in the order of teaching mathematics in the older public schools, and contains a suggestion as to how such a change could be effected.

The points I wish to call attention to in this letter are that (1) the hands of mathematical teachers in these schools are tied by the conditions of the University examinations; (2) in arithmetic more attention should be paid to the decimal system; (3) the Euclid should be curtailed and some of it put into algebraical form; (4) too much time is given to artificial questions in algebra; (5) trigonometry ought to be begun earlier; (6) more hours might be allotted in the week to mathematics and physics; and (7) the classics are given an abnormal and unjustifiable preponderance in an ordinary boy's education.

I am quite aware that the difficulties to be overcome in effecting any rational common-sense change in the methods and order of teaching elementary mathematics will be very great, but let us hope they will not prove insurmountable.

To begin with, the public schools for boys of average ability are bound to more or less base their scheme of work on the pass requirements of the Universities, though perhaps at Eton this may be less the case than at many other schools. After those requirements have been satisfied the teaching does not by any means always shape itself in the direction of the work a boy may afterwards follow while at the University or in after life. As things are, what is the present condition of the average boy at our older public schools?

In arithmetic he gains a certain amount of proficiency in those fractions known as vulgar, he learns the artificial rules for extracting square and cube roots, he works out problems involving questions of time and work, or of time and distance, or of areas, he becomes quite proficient in the ordinary matters of compound interest, discount, stocks and shares, and he even gains an idea of what a stockbroker is. I am not prepared to say that all this has not its educational, and even its commercial, value later on, for it certainly has; but what I maintain is that we do not go far enough. There is not enough chance, our pass examinations being what they are, of boys seeing the value and importance of the decimal system as applied to physical measurements and problems. They are often apt to imagine that a result must be absolutely correct to its last decimal place, or it is valueless; and the methods of approximation are often excluded from their course altogether, either as being not sufficiently accurate or not required for the University entrance or pass examinations.

Let us turn now to the question of Euclid. Geometry is an excellent form of mental gymnastics when it is taught in the proper way, but the manner in which it is presented to the boy in our editions of the great geometer is antiquated and out of date. Far too much in this abstract science is left to the imagination, a quality which the ordinary boy frequently lacks; and ocular demonstration is but little resorted to in order to give him, by means of figures and models cut out of cardboard, a clearer idea of what he is required to prove. I also venture to think that the Euclid, such as we know it, is spun out to an excessive length, and too often the patience and courage of the average boy is well-nigh spent before he gets to the end of it.

I am fully aware of the existence of that useful body known as the Association for the Improvement of Geometrical Teaching, or, as it is now called, the Mathematical Association, of

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